REMARKS

With entry of the present amendment the application will contain claims 1-6.

Support

Support for new claims 5 and 6 can be found in the specification as filed in general and in particular in the paragraph beginning on page 4 at line 12.

Allowable Subject Matter

The Examiner is thanked for indicating the presence of allowable subject matter in dependent claim 3. Claim 3 has been rewritten in independent form and is clearly now allowable.

Issues under 35 USC §102(b) and 35 USC §103(a)

The rejection of claims 1 and 4 as anticipated by US patent 6,080,232 (Sperlich) is traversed. As explained more fully below Sperlich does not disclose the subject matter here claimed.

The rejection of claim 2 as obvious under 35 USC 103 over Sperlich is traversed. As explained more fully below Sperlich does not render obvious the subject matter here claimed.

When rare-earth oxides are used in trays for sintering carbide tools, constituents of the carbide (e.g., tungsten carbide and carbon) stick to the white surface and appear to contaminate the tray as foreign matter. Moreover, such contamination creates black

and white areas on the tray, which results in a non-uniform radiation efficiency during high-temperature sintering. This causes elongated tools to warp.

Furthermore, when rare-earth oxides are used in components for plasma etching chamber using halogen gases, resist decomposition product residues adhere to the component following use, creating areas of brown discoloration. Because such areas invariably receive more attention in the cleaning operation, in spite of being endowed with good plasma erosion resistance and thus inherently greater longevity, the component tends to be excessively cleaned, shortening its useful life.

The present invention overcomes the above prior art problems. The present invention provides articles having a thermal spray coating layer that imparts increased uniformity of radiation at elevated temperatures and thus causes minimal warping and undergo little or no local color change with use. The invention also provides rare-earth oxide powders for thermal spraying which makes it possible to produce such spray coated articles.

More specifically, the above problems arise from the fact that rare-earth oxides basically exhibit a white color. One possible solution is to add another element to change the rare-earth oxide to a gray or black color. However, when such a modified rare-earth oxide thermal spraying powder is used in a sintering tray, it is necessary to prevent the admixture of foreign matter in the objects

sintered on the tray. Likewise, plasma erosion resistant articles, obtained by thermal spray coating a rare-earth oxide powder onto a substrate, are used primarily in semiconductor fabrication processes, and must therefore be non-contaminating.

Given the long-felt need to hold down the amount of any additional material added, the inventors have sought a way of including a small amount of an element to form a rare-earth oxide thermal sprayed layer which is gray or black in color. The inventors have discovered that the addition of carbon, titanium or molybdenum, particularly in an amount of 0.1 to 2% by weight, for carbon, or in an amount of 1 to 1000 ppm for titanium or molybdenum, is effective for this purpose. They have also found that thermally spray coated articles having a gray or black color can be manufactured by using a rare-earth oxide thermal spraying powder of a gray or black color having, in the $L^*a^*b^*$ color space, an L^* value of up to 50, an a^* value of -3.0 to +3.0 and a b^* value of -3.0 to +3.0.

Claims 1 and 4 are not anticipated by Sperlich. Sperlich discloses a process for producing a spherical colored pigment having an average particle diameter of from 0.5 μm to less than 10 μm and a spinel or an inverse spinel structure of the general formula AB_2O_4, $B(AB)O_4$ or DE_2O_4. Herein A is selected from the group consisting of Mg^{2+}, Ca^{2+}, Sr^{2+}, Ba^{2+}, Mn^{2+}, Fe^{2+}, Co^{2+}, Ni^{2+}, Cu^{2+} and Zn^{2+}, B is selected from the group consisting of Al^{3+}, Ga^{3+}, In^{3+},

Sc^{3+}, Ln^{3+}, Ti^{3+}, V^{3+}, Cr^{3+}, Fe^{3+}, Ni^{3+}, and Co^{3+}, D is selected from the group consisting of Ti^{4+} and Zr^{4+}, and E is selected from the group consisting of Fe^{2+}, Co^{2+} and Ni^{2+}.

The Examiner alleges that Sperlich teaches a pigment that may be deposited as a color paste by screen-printing, which is considered a coating on a substrate.

However, this is incorrect. Firstly, Sperlich fails to disclose a rare-earth oxide thermal spray coated article. It is the pigments per se that are obtained by spray-pyrolysis technique (abstract), not an article which has a thermal spray coating layer of the rare-earth oxide powders.

The Sperlich pigment is not melted but is only deposited on the substrate. On the other hand, the thermal spray coated article of the invention can be fabricated by using a thermal spraying process, such as plasma spraying or low-pressure plasma spraying, to form a layer of the rare-earth oxide thermal spraying powder on the surface of the substrate. Furthermore, during thermal spraying, particles of the inventive composition can melt completely within the plasma flame to form the thermal sprayed coating adhering with great strength to the substrate.

Thus, the deposited coating of Sperlich is quite different from the thermal spray coating of the invention.

Secondly, Sperlich fails to disclose or teach thermal spray coated articles having the specific $L^*a^*b^*$ values.

Sperlich may disclose that the pigments have a deep-black color, and may show that the paste containing dispersed pigment of $CoNiCrFeO_4$ is used for indirect printing (transfer technique), followed by firing on porcelain, which shows a deeper black (=lower L^* value) in Example 6. However, this is not a disclosure of thermal spray coated articles. Furthermore the Sperlich printed porcelain having the $L^*a^*b^*$ values does not have a rare-earth oxide coating.

By contrast, the present invention uses a rare-earth oxide thermal spraying powder having the specific $L^*a^*b^*$ values. The claimed invention provides articles having a substrate and a thermally sprayed coating of the rare-earth oxide powder onto a substrate, which shows the specific $L^*a^*b^*$ values. As a result, the radiation at elevated temperatures becomes more uniform, enabling the production of cemented carbide bodies having minimal warp. Moreover, when a thermal spray coated article, according to the invention, is used as a plasma erosion resistant component in a halogen gas, local discoloration is limited. Thus, when taken out and cleaned, the component is not excessively cleaned at localized places. This results in an advantageous, unexpectedly-long, service life.

Accordingly, the rare-earth oxide thermal spray coated article having the specific $L^*a^*b^*$ values as well as the rare-earth oxide

thermal spraying powder having the specific $L^*a^*b^*$ values according to the invention are neither disclosed nor suggested by Sperlich.

Claim 2 has been rejected as obvious over Sperlich, but it is not. The Sperlich pigments are spinels of the formula AB_2O_4 wherein B may be one or more trivalent elements selected from the group containing Ln^{3+} and Ti^{3+}.

However, as discussed above, Sperlich fails to disclose or teach the rare-earth oxide thermal spray coated article having the specific $L^*a^*b^*$ values.

Sperlich is directed only to the pigment which is employed for the coloring of plastics such as, in particular, fibers and foils and lacquers, and also in connection with the production of decorative colors and enamels and the application thereof by means of screen printing.

On the other hand, the inventors have sought a way of including, and holding down to a small amount, an element to form a rare-earth oxide thermal sprayed layer which is gray or black in color. As a result, the inventors have found that articles having the layer which contains a gray or black color-imparting material, that is preferably carbon, titanium or molybdenum, impart increased uniformity of radiation at elevated temperatures and thus causes only minimal warping and undergoes little or no local color change with use. The inventors have also found that thermally spray coated articles having a gray or black color can be manufactured by

using a rare-earth oxide thermal spraying powder of a gray or black color having the specific $L^*a^*b^*$ values. Sperlich fails to teach or suggest the inventive articles and the features thereof.

Accordingly, the inventive rare-earth oxide thermal spray coated articles having the specific $L^*a^*b^*$ values and the thermal spraying rare-earth oxide powder having $L^*a^*b^*$ values and the features thereof are neither disclosed not suggested by Sperlich.

Conclusion

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact David R. Murphy (Reg. No. 22,751) at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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